CLAIMS

1. A measurement device comprising:

a first object having a first pattern;

a second object having a second pattern corresponding to the first pattern;

a projection system configured to project an image of the first pattern onto the second pattern; and

a detector configured to measure an amplitude of at least one order of a diffraction pattern resulting from an interference of the second pattern and the projected image.

2. The measurement device according to claim 1, wherein the second pattern comprises a first longitudinal structure oriented along a first direction and a second longitudinal structure oriented along a second direction.

3. The measurement device according to claim 2, wherein the first longitudinal structure alternates with the second longitudinal structure along at least one of the first and second directions.

4. The measurement device according to claim 1, wherein said detector includes a photo detector.

5. The measurement device according to claim 1, wherein said detector is configured to measure the amplitude in synchronism with an illumination of the first pattern.

6. The measurement device according to claim 1, wherein said detector is configured to measure the amplitude in synchronism with a

measurement of a position of at least one of the first pattern and the second pattern.

7. The measurement device according to claim 1, wherein the second pattern includes at least one phase grating, and

wherein the projected image has a wavelength λ, and

wherein the at least one phase grating has a grating depth of substantially $\lambda/4$.

8. The measurement device according to claim 1, wherein said detector is arranged to measure an amplitude of at least an even diffraction order of the diffraction pattern.

9. The measurement device according to claim 8, wherein said detector is arranged to measure the amplitude of at least an even diffraction order simultaneously with an amplitude of at least one odd diffraction order of the diffraction pattern.

10. The measurement device according to claim 1, wherein the detector is configured to measure an amplitude of more than one diffraction order of the diffraction pattern, and

wherein at least one of the more than one diffraction orders has a low sensitivity to relative position changes of the first pattern with respect to the second pattern as compared to another order of the diffraction pattern.

11. The measurement device according to claim 10, wherein the measurement device is configured to correct a measured amplitude of at least one order of the diffraction pattern based on a measured amplitude of at least

one other order of the diffraction pattern.

12. The measurement device according to claim 1, wherein the second pattern includes at least one phase grating, and

wherein the projected image has a wavelength λ, and

wherein at least one of the diffraction orders of the diffraction pattern is relatively insensitive to modulation with respect to a relative position of the projected image and the second pattern as compared to at least one of the other orders of the diffraction pattern.

13. The measurement device according to claim 12, wherein the second pattern comprises at least one phase grating, and

wherein the projected image has a wavelength λ, and

wherein at least one among the first pattern and a grating depth of the at least one phase grating is selected to provide the relative insensitivity.

14. The measurement device according to claim 1, wherein said detector is located outside the projected image.

15. The measurement device according to claim 1, wherein the measurement device is configured to calibrate an overlay measurement based on a relation between the measured amplitude and a corresponding relative displacement of the first pattern and the second pattern.

16. The measurement device according to claim 1, wherein the detector is configured to measure the amplitude again at a different relative position of the first pattern with respect to the second pattern.

17. The measurement device according to claim 1, wherein the projection system is further configured to project the first pattern onto a wafer comprising at least one die, and

wherein the detector is further configured to measure an amplitude of the at least one order of a diffraction pattern resulting from an interference of the wafer and the projected image.

18. A lithographic apparatus comprising:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure configured to impart the beam with a pattern in its cross-section;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam onto a target portion of the substrate;

a first object having at least a first pattern;

a second object having a second pattern corresponding to said first pattern; and

a detector,

wherein the illumination system is configured to illuminate the first pattern, and

wherein the projection system is configured to project a patterned beam including an image of the first pattern onto the second pattern, and

wherein the detector is configured to measure an amplitude of at least one order of a diffraction pattern resulting from interference between the second pattern and the projected image.

19. The lithographic apparatus according to claim 18, wherein said

lithographic apparatus further comprises at least a meter configured to measure a position of at least one among the first object, the second object, and the substrate table, and

wherein said detector is configured to measure the amplitude and said meter is configured to measure the position in synchronism with each other.

20. The lithographic apparatus according to claim 18, wherein the lithographic apparatus is configured to calibrate an overlay measurement based on a relation between the measured amplitude and a corresponding relative displacement of the first pattern and the second pattern.

21. A method for measurement, said method comprising:

illuminating a first object having at least a first pattern;

projecting an image of the first pattern onto a second object having a second pattern corresponding to the first pattern; and

measuring an amplitude of at least one order of a diffraction pattern resulting from interference between the second pattern and the projected image.

22. The method according to claim 21, wherein said illuminating includes using a radiation system to provide a beam of radiation.

23. The method according to claim 21, wherein said method further comprises:

using a patterning structure to impart a beam of radiation with a pattern in its cross-section; and

projecting the patterned beam onto a target portion of a layer of radiation-sensitive material that at least partially covers a substrate,

wherein said projecting the patterned beam includes positioning at least one among the patterning structure and the substrate based on the measured amplitude.

24. The method according to claim 21, wherein the second pattern includes at least one phase grating, and

wherein the projected image has a wavelength λ, and

wherein the at least one phase grating has a grating depth of substantially $\lambda/4$.

25. The method according to claim 21, wherein said measuring an amplitude includes measuring an amplitude of more than one diffraction order of the diffraction pattern, and

wherein at least one of the more than one diffraction orders has a low sensitivity to relative position changes of the first pattern with respect to the second pattern as compared to another order of the diffraction pattern.

26. The method according to claim 25, said method further comprising correcting a measured amplitude of at least one order of the diffraction pattern based on a measured amplitude of at least one other order of the diffraction pattern.

27. The method according to claim 21, said method further comprising calibrating an overlay measurement based on a relation between the measured amplitude and a corresponding relative displacement of the first pattern and the second pattern.

28. The method according to claim 21, said method further

comprising measuring the amplitude again at a different relative position of the first pattern with respect to the second pattern.